

CLAIMS

What is claimed is:

5 1. A fluid treatment system comprising:
a sealed fluid flow path including a treatment chamber portion
and containing a fluid to be passed therethrough and treated with light, the
treatment zone transmissive to at least 1% of the light having at least one
wavelength within a range of 170 to 2600 nm, the sealed fluid flow path
removable from a light treatment system.

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2. The system of Claim 1 wherein the sealed flexible fluid flow
path includes:

an input conduit for supplying first fluid the fluid to be treated;
the treatment chamber portion sealingly coupled to the input
15 conduit; and

an output conduit sealingly coupled to the treatment chamber
portion, wherein the fluid is to be flowed from the input conduit through the
treatment chamber portion and out the output conduit, wherein the fluid is to
be treated with the light as it flows through the treatment chamber portion.

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3. The system of Claim 2 further comprising a first container
portion coupled the input conduit containing the fluid to be treated.

4. The system of Claim 3 further comprising a second container
25 portion coupled to the output conduit for receiving the fluid once treated.

5. The system of Claim 4 further comprising a third fluid
container portion coupled to the output conduit, wherein a portion of the
fluid flowed through the treatment chamber portion is to be collected in the
30 second fluid container portion and another portion of the fluid flowed

through the treatment chamber portion is to be collected in the third fluid container portion.

5 6. The system of Claim 4 further comprising an actuator assembly coupled to the first fluid container portion for causing the fluid to be flowed through the sealed flexible fluid flow path at a specified flow rate.

10 7. The system of Claim 2 wherein the treatment chamber portion is positioned to receive the light from a light source.

10 8. The system of Claim 2 further comprising:
a first process monitor coupled to the input conduit; and
a second process monitor coupled to the output conduit.

15 9. The system of Claim 8 wherein one or more of the first process monitor and the second process monitor are selected from a group consisting of: a pressure sensor and a temperature sensor.

20 10. The system of Claim 1 wherein the sealed fluid flow path comprises a flexible sealed fluid flow path.

11. The system of Claim 1 wherein a treatment chamber portion of the sealed fluid flow path is flexible.

25 12. A fluid treatment system comprising:
a sealed fluid flow path including a treatment chamber portion and containing a fluid to be passed therethrough and treated with light, the treatment zone transmissive to at least 1% of the light having at least one wavelength within a range of 170 to 2600 nm.

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13. A fluid treatment system comprising:

a sealed fluid flow path comprising:

a first fluid container portion for containing a fluid to be treated with light;

a treatment chamber portion sealingly coupled to an input of the first fluid container portion, wherein the treatment chamber portion transmits at least 1% of the light having at least one wavelength within a range of 170 to 2600 nm; and

a second fluid container portion sealingly coupled to an output of the treatment chamber portion, wherein the fluid is to be flowed from the first fluid container portion through the treatment chamber portion to the second fluid container portion, wherein the fluid is to be treated with the light as it flows through the treatment chamber portion.

14. The system of Claim 13 wherein the treatment chamber portion is made of a flexible material.

15. The system of Claim 13 wherein the sealed fluid flow path is removable from a light treatment system.

16. A method of treating a fluid product with light comprising:
flowing the fluid product from one portion of a sealed fluid flow path containing the fluid product to another portion of the sealed fluid flow path; and

illuminating the fluid product with light having at least one wavelength within a range of 170 to 2600 nm as the fluid product is flowed through the sealed flexible fluid flow path in order to deactivate pathogens within the fluid product.

17. The method of Claim 16 wherein the flowing step comprises

flowing the fluid product from one portion of a sealed flexible fluid flow path containing the fluid product to another portion of the sealed flexible fluid flow path.

5 18. The method of Claim 16 wherein the flowing step comprises:

 flowing the fluid product from a first fluid container portion of the sealed fluid flow path through a treatment chamber portion of the sealed fluid flow path to a second fluid container portion of the sealed fluid flow path, the first fluid container portion sealingly coupled to an input of the treatment chamber portion and the second fluid container portion sealingly coupled to an output of the treatment chamber portion.

15 19. The method of Claim 18 further comprising sealing the fluid product within the first fluid container portion.

20 20. The method of Claim 18 further comprising removing, after the illuminating step, the first fluid container portion, the second fluid container portion and the treatment chamber portion from a fluid treatment system.

25 21. The method of Claim 20 further comprising replacing the first fluid container portion, the second fluid container portion and the treatment chamber portion having been removed from the fluid treatment system, with another first fluid container portion containing another fluid to be treated, another second fluid container portion, and another treatment chamber portion in the fluid treatment system.

30 22. The method of Claim 18 further comprising removing, after the illuminating step, the first fluid container portion, the second fluid

container portion and the treatment chamber portion from a fluid treatment system sealingly coupled together.

23. The method of Claim 18 further comprising unsealing the
5 second fluid container portion from the sealed fluid flow path.

24. The method of Claim 23 further comprising removing the
second fluid container portion from a fluid treatment system containing the
sealed fluid flow path.

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25. The method of Claim 18 wherein the illuminating step
comprises illuminating the fluid product with pulses of light.

26. The method of Claim 25 wherein the illuminating step
15 comprises illuminating the fluid product with the pulses of light having
wavelengths within a spectral range of at least between 240 nm and 280 nm
and having a pulse duration of less than 100 ms.

27. The method of Claim 25 wherein the illuminating step
20 comprises illuminating the fluid product with the pulses of light having a
fluence greater than 0.001 J/cm^2 .

28. The method of Claim 25 wherein the illuminating step
comprises illuminating the fluid product with the pulses of light, wherein at
25 least 0.5% of the fluence of the pulses of light is concentrated at wavelengths
within a range of 200 nm to 320 nm.

29. A method of treating a fluid product with light comprising:
flowing the fluid product from a first fluid container portion of a
sealed fluid flow path through a treatment chamber portion of the sealed fluid
flow path to a second fluid container portion of the sealed fluid flow path, the
5 first fluid container portion sealingly coupled to an input of the treatment
chamber portion and the second fluid container portion sealingly coupled to
an output of the treatment chamber portion; and
illuminating the fluid product with light as it is flowed through
the treatment chamber portion in order to deactivate pathogens within the
10 fluid product.

30. The method of Claim 29 wherein the treatment chamber
portion comprises a flexible treatment chamber portion.

15 31. The method of Claim 29 wherein the illuminating step
comprises illuminating the fluid product with pulses of light.